

CLAIMS

1. A liquid dispenser comprising:  
a housing;  
a plurality of interconnected chambers disposed within the housing into which liquid is drawn and from which liquid is expelled;  
5 apparatus connected to the chambers for drawing a measured amount of liquid into each of the chambers and for expelling from each of the chambers another measured amount of liquid;  
an opening disposed at one end of each chamber into which liquid may be drawn;  
and  
10 slideways supporting the plurality of chambers and the apparatus for drawing and expelling liquid from the chambers, said plurality of chambers and said apparatus for drawing and expelling liquid being slidable into and out of the housing along the slideways.

2. The liquid dispenser as recited in claim 1 further comprising manually operable apparatus for retaining the plurality of chambers and the apparatus for drawing and expelling liquid within the housing.

3. The liquid dispenser as recited in claim 2, wherein the attaching apparatus comprises:  
a plurality of threaded shafts pivotally mounted to the apparatus for drawing and expelling liquid;  
5 a support disposed within the housing;  
cutouts on the support for receiving each threaded shaft; and  
a knob threadably mounted on each threaded shaft, said knobs being rotatable about the shaft to be screwed into engagement with said support for securing said apparatus for drawing and expelling liquid to the plate.

4. The liquid dispenser as recited in claim 1 further comprising:

a plurality of tips, each tip being associated with one of the chambers, each tip having a first end with an enlarged opening, and a second end having a smaller opening than the opening of the first end, the first end of each tip being in liquid communication  
5 with the opening of an associated chamber; and

a flexible seal extending around each chamber opening and being engaged by the first end of an associated one of the tips providing a substantially air- and liquid-tight seal between the first end of the associated tip, and the opening.

5. The liquid dispenser as recited in claim 4, wherein the seal comprises a layer which covers substantially all of the space between adjacent ones of the openings of the chambers.

6. The liquid dispenser as recited in claim 4, wherein the seal is formed of silicone.

7. The liquid dispenser as recited in claim 4 wherein the tips are carried in a tray, the liquid dispenser further comprising:

a clamp for clamping the tray against a wall of the housing; and  
apparatus urging the clamp against the wall of the housing for maintaining a  
5 clamping force on the tray against the housing wall.

8. The liquid dispenser as recited in claim 7, wherein the urging apparatus comprises at least one spring.

9. The liquid dispenser as recited in claim 7, wherein the clamp is engageable by the apparatus for drawing and expelling liquid to move the clamp away from the wall of the housing against the clamping force of the urging apparatus to release the clamping force on the tray.

10. The liquid dispenser as recited in claim 1 wherein said apparatus for drawing and expelling liquid comprises:

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a plurality of pistons, each piston being moveable within one of said chambers;  
a plate coupled to each of said pistons;  
5 a motor operably coupled to the plate for moving the plate toward and away from  
the chambers to cause movement of said pistons within the chambers.

11. The liquid dispenser as recited in claim 10 further comprising:  
a tray containing a plurality of tips, the tray having extensions, each tip including  
a first end having an enlarged opening and a second end having an opening smaller than  
the opening of the first end;

5 at least two brackets being mounted on the housing and being movable with  
respect to the housing for clamping the extensions of the tray against the housing so that  
the first end of each tip is in fluid communication with one of said openings; and

a connection between the plate and the brackets for moving the brackets away  
from the housing in response to movement of the plate to release the extensions of the  
10 tray.

12. The liquid dispenser as recited in claim 11 further comprising a spring for  
urging the brackets against the housing for providing a clamping force on the extensions  
of the tray.

13. A liquid transfer apparatus comprising:  
a source of liquid to be dispensed;  
a head for withdrawing liquid from the source of liquid through a plurality of  
dispensing tips, and for dispensing the liquid in measured amounts through the  
5 dispensing tips into wells of plates; and

an assembly for storing, receiving and providing plates containing wells into  
which liquid is to be dispensed, said assembly comprising:

at least one stacker for containing a stack of plates and having a top  
opening and a bottom opening;

10 a base on which the stacker rests, the base having an opening  
communicating with the bottom opening of the stacker through which plates may

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be received by the stacker and from which plates may be withdrawn from the stacker;

15 retractable arms disposed adjacent the base opening and below a  
lowermost plate stacked within the stacker, the arms being normally in a first  
position in which the arms extend into the base opening and engage a lowermost  
plate, said arms being retractable to a second position away from the base  
opening in which the arms do not engage the lowermost plate of the stacker to  
20 permit selective insertion and removal of plates from the stacker through the base  
opening and the bottom opening of the stacker.

14. The liquid transfer apparatus as recited in claim 13 wherein the stacker  
further comprises two flaps which are moveable from a closed position in which they do  
not engage plates within the stacker to an open position in which the flaps extend into the  
bottom opening of the stacker to engage a lowermost plate within the stacker, said flaps  
5 being in their closed position when the stacker rests on the base.

15. The liquid transfer apparatus as recited in claim 14, further comprising a  
biasing member biasing the flaps into their open position.

16. The liquid transfer apparatus as recited in claim 15, wherein the flaps are  
forced into their closed position against the bias of the biasing member when the stacker  
rests on the base by a wall member on the base.

17. The liquid transfer apparatus as recited in claim 13, wherein the stacker  
comprises at least one pivotally mounted door which may be opened to permit insertion  
of plates into the stacker and closed to retain the plates within the stacker.

18. The liquid transfer apparatus as recited in claim 17, further comprising a lock  
for keeping the door closed.

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19. The liquid transfer apparatus as recited in claim 18, wherein the lock comprises a pin which is in registration with an associated pole in the stacker when the door is closed.

20. The liquid transfer apparatus as recited in claim 19, wherein the door pivots about an axis, and wherein the door may be moved in a direction generally parallel to the axis of pivoting to withdraw the pin from its associated hole to permit rotation of the door from a closed position to an open position.

21. The liquid transfer apparatus as recited in claim 17, wherein the stacker comprises two doors.

22. The liquid transfer apparatus as recited in claim 13, further comprising at least one button for attaching the stacker to the base, and for aligning the stacker with the base.

23. The liquid transfer apparatus as recited in claim 22, comprising a pair of buttons associated with the base which slide into correspondingly formed slots in the stacker.

24. The liquid transfer apparatus as recited in claim 13, further comprising a handle affixed to the stacker.

25. An apparatus for dispensing plates having wells for containing a liquid, said plate dispensing apparatus comprising:

a stacker containing a stack of plates to be dispensed having a lower, open end;

a base in which the stacker seats and having an opening communicating with the

5 lower, open end of the stacker;

a plurality of retractable arms disposed in the base, the arms being in a normally extended position in which the arms extend into the base opening to engage a plate in the lower end of the stacker to prevent the plate from passing through the base opening, the

arms being retractable away from the base opening and out of engagement with plates in  
10 the stacker to permit plates to pass through the base opening.

26. The plate dispensing apparatus as recited in claim 25, wherein said stacker  
can be removed from the base.

27. The plate dispensing apparatus as recited in claim 25, wherein the stacker  
comprises at least two flaps which are moveable from an open position in which the flaps  
extend into the open end of the stacker to engage a plate within the stacker, and a closed  
position in which the plates are pivoted away from the open end and away from the  
5 plates.

28. The plate dispensing apparatus as recited in claim 27, wherein the flaps are  
disposed in their closed position wherein the stacker is seated in the base.

29. The plate dispensing apparatus as recited in claim 27, wherein said flaps are  
normally biased into their open position.

30. The plate dispensing apparatus as recited in claim 28, further comprising a  
member disposed in the base for retaining each flap in its closed position.

31. The plate dispensing apparatus as recited in claim 28, wherein the flaps  
return to their open position upon removal of the stacker from the base.

32. The plate dispensing apparatus as recited in claim 25, wherein the stacker  
comprises at least one pivotally mounted door which may be opened for insertion of  
plates.

33. The plate dispensing apparatus as recited in claim 32, further comprising a  
lock for retaining the door in a closed position.

34. The plate dispensing apparatus as recited in claim 33, wherein the lock comprises a pin extending into a hole.

35. The plate dispensing apparatus as recited in claim 34, wherein the pin is affixed to a top end of the door, and wherein the door is slidable in an upward direction to lift the pin out of the hole.

36. The plate dispensing apparatus as recited in claim 25, further comprising a slot on the stacker which is engageable by a button on the base for aligning and retaining the stacker in a seated position on the base.

37. The plate dispensing apparatus of claim 36 further comprising a second button vertically aligned with the first button on the base and a second slot on the stacker for engagement by the second button.

38. A method for dispensing plates from a stacker assembly for use in a liquid dispensing apparatus, the method comprising the steps of:

stacking plates within a stacker;

5 retaining the plates within the stacker using retractable arms which extend into the stacker assembly and engage a lowermost plate in the assembly;

withdrawing all of the arms at once to allow a single plate to pass through an opening in the stacker assembly; and

returning the arms to an extended position after a predetermined period of time to engage the next lowermost plate in the stacker assembly.